

CLAIMS

1. Hydraulic control system (10) for a clutch (12) in particular for a motor vehicle, comprising an upstream sending cylinder (14) connected by a conduit (16) to a downstream receiving cylinder (18), so as to form a hydraulic control circuit (19), characterised in that it comprises an assistance cylinder (30) that is interposed in the conduit (16), between the sending cylinder (14) and the receiving cylinder (18), and which comprises at least one assistance piston (32) that is mounted so as to slide axially (A1) in the body (56) of the assistance cylinder (30) between an upstream engagement position and a downstream disengagement position, so as to delimit an upstream hydraulic chamber (34) and a downstream hydraulic chamber (36) with variable volumes according to the axial position of the piston (32), the upstream chamber (34) being connected to the sending cylinder (14) by a portion of hydraulic circuit referred to the upstream circuit (40) and the downstream chamber (36) being connected to the receiving cylinder (18) by a portion of the hydraulic circuit referred to as the downstream circuit (44), each hydraulic circuit portion (40, 44) comprising a means (52, 102, 150) of releveing the volume of fluid connected to at least one fluid reservoir (29), and in that the assistance cylinder (30) comprises an assistance device (50) that applies an assistance force (F_a) to the assistance piston (32) during the declutching phase.

2. Control system (10) according to the preceding claim, characterised in that the assistance device (50) comprises a regulation means (114, 115, 180, 210, 212,

218, 220) which makes the value of the assistance force (F_a) vary according to the travel (C_p) of the clutch control pedal (22) in accordance with a predetermined assistance law.

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3. Control system (10) according to any one of the preceding claims, characterised in that the assistance device (50) comprises a transmission member (48, 70, 71) which transmits the assistance force (F_a) to the
10 assistance piston (32).

4. Control system (10) according to the preceding claim, characterised in that the transmission member (48, 70, 71) is connected in terms of axial movement to the
15 assistance piston (32) in both directions of sliding of the piston (32).

5. Control system (10) according to claim 3, characterised in that the transmission member (48, 71)
20 cooperates by contact with an associated abutment surface (138) of the assistance piston (32) so that, in the case where the speed of the assistance device (50) is less than the speed of the assistance piston (32), the assistance device (50) does not slow down the sliding of
25 the assistance piston (32) towards the downstream end.

6. Control system (10) according to any one of claims 3 to 5, characterised in that the transmission member (48, 71) is arranged at an axial end of the assistance piston
30 (32).

7. Control system (10) according to any one of claims 3 to 5, characterised in that the piston (32) comprises an upstream portion (62) that delimits the upstream chamber

(34) and a downstream portion (66) that delimits the downstream chamber (36), and the two portions (62, 66) are connected in axial movement by a connecting rod (70), and in that the connecting rod (70) constitutes the transmission member (71) of the assistance device (50).

8. Control system (10) according to any one of the preceding claims, of the type in which the hydraulic circuit (19) is connected to a fluid reservoir (29) in the engagement position, characterised in that the assistance cylinder (30) comprises at least one discharge orifice (52, 102, 150) which makes at least one hydraulic chamber (36) communicate with the fluid reservoir (29), when the assistance piston (32) is occupying its upstream position, so as to compensate for the variations in hydraulic volume in the hydraulic circuit (19) over time.

9. Control system (10) according to the preceding claim, characterised in that the discharge orifice (52) is arranged in the assistance piston (32) and in that the discharge orifice (52) makes the upstream chamber (34) communicate with the downstream chamber (36), when the assistance piston is occupying its upstream position.

10. Control system (10) according to claim 8 or 9, characterised in that the discharge orifice (52, 150) comprises a valve (54, 148) that is controlled by the axial movement of the assistance piston (32).

11. Control system (10) according to any one of the preceding claims, characterised in that the assistance device (50) comprises an elastic element (106, 172) which stores energy during the engagement phase and which restores the energy during the disengagement phase in

order to produce the assistance force (F_a).

12. Control system (10) according to the preceding claim taken in combination with claim 2, characterised in that
5 the regulation means (115) is a cam mechanism (114) which is driven by the axial movement of the piston (32) and which regulates the assistance force (F_a) produced by the elastic element (106) during the disengagement phase.

10 13. Control system (10) according to the preceding claim, characterised in that the assistance device (50) is housed in the cylinder body (56) and in that the cam mechanism (114) comprises at least one control surface (120, 122) that is produced on an internal wall of the
15 cylinder body (56).

14. Control system (10) according claim 12 or 13, characterised in that the elastic assistance element (106) is an axial compression elastic element that is
20 interposed axially between a cup (108) and an abutment surface (110) fixed with respect to the assistance cylinder body (56), in that the cam mechanism (114) comprises at least one movable roller (116, 118) which travels over a control surface (120, 122) between an
25 upstream position and a downstream position corresponding respectively to the upstream and downstream positions of the assistance piston (32), and in that the movable roller (116, 118) is connected by a first connecting rod (124) to the piston (32) by a second connecting rod (126)
30 to the cup (108).

15. Control system (10) according to the preceding claim, characterised in that the axis by which the connecting rods (124, 126) pivot on the movable roller

(116, 118) is concurrent with the rotation axis (A2) of the roller (116, 118).

16. Control system (10) according to claim 14 or 15,
5 characterised in that the control surface (120, 122) comprises an upstream portion (134) inclined with respect to the sliding axis (A1), and a downstream portion (136) roughly parallel to the sliding axis (A1) so that, during a first part of the disengagement phase, the movable
10 roller (116, 118) moves first of all on the inclined portion (134) towards the axis (A1) and in the downstream direction, from its upstream position, transmitting part of the relaxation force of the elastic assistance element (106) to the assistance piston (32), by a step-down
15 effect, and then, during a second part of the disengagement phase, the movable roller (116, 118) moves on the downstream portion (136) in the downstream direction, in a roughly axial direction, transmitting all the relaxation force of the elastic assistance element
20 (106) to the assistance piston (32).

17. Control system (10) according to the preceding claim, characterised in that the distance between the pivot axes of the second connecting rod (126) is such
25 that, in the upstream position of the movable roller (116, 118), the roller moves in the upstream direction beyond the point (B1) on the control surface (120, 122) where the second connecting rod (126) is perpendicular to the control surface (120, 122), so that the expansion
30 force of the elastic assistance element (106) biases the movement roller (116, 118) towards its upstream position.

18. Control system (10) according to any one of claims 14 to 17, characterised in that the axial dimension of

the elastic assistance force (106) in the relaxed state is less than the axial distance between the cup (108) and the associated fixed abutment surface (110), when the piston (32) occupies its downstream position, so as to
5 eliminate the assistance force (F_a) during the end of the travel of the piston (32) in the downstream direction.

19. Control system (10) according to claim 11, characterised in that the assistance device (50)
10 comprises an electrical actuator (170) that controls the relaxation of the elastic element (172) during the disengagement phase.

20. Control system (10) according to the preceding claim
15 taken in combination with claim 2, characterised in that the means (115) of regulating the assistance device (50) is an electronic control unit (180) that controls the electrical actuator (170).

20 21. Control system (10) according to any one of claims 11 to 20, characterised in that the elastic assistance element (106, 172) is a helical compression spring.

22. Control system (10) according to any one of claims 1
25 to 10, characterised in that the assistance device (50) is connected to an energy source that is external to the control system (10) and that is installed in the vehicle that the control system (10) equips, and in that the said energy produces the assistance force (F_a) that is
30 transmitted to the piston (32).

23. Control system (10) according to the preceding claim, characterised in that the assistance device (50) comprises an electrical actuator (186) controlled so as

to transmit an assistance force (F_a) to the piston (32) during the disengagement phase.

24. Control system (10) according to the preceding claim taken in combination with claim 2, characterised in that the means (115) of regulating the assistance device (50) is an electronic control unit that controls the electrical actuator (186) producing the assistance force (F_a).

25. Control system (10) according to claim 22, characterised in that the assistance device (50) comprises a ram (154) that is connected to a hydraulic or pneumatic pressure source (184) and that transmits an assistance force (F_a) to the piston (32) during the disengagement phase.

26. Control system (10) according to the preceding claim taken in combination with claim 2, characterised in that the means (115) of regulating the assistance device (50) comprises at least one control valve (210, 212, 218) interposed between the ram (194) and the hydraulic or pneumatic pressure source (184).

27. Control system (10) according to the preceding claim, characterised in that the regulation means (115) comprises a two-position control valve (210) connected to a pressure source (184) in order to form a charging valve (212) and a two-position control valve connected to a fluid reservoir (29) in order to form a discharge valve, and in that each control valve (210, 212) is controlled by the hydraulic pressure (P_h) in the upstream circuit (40), so that the hydraulic pressure (P_h) in the upstream circuit (40) tends towards a first constant value (P_{hr})

during a disengagement travel and tends towards a second constant value (P_{hs}), less than the first value (P_{hr}), during an engagement travel.

5 28. Control system (10) according to claim 26,
characterised in that the regulation means (115)
comprises a three-position control valve (218), a
charging position that is connected to a pressure source
10 (184), an intermediate closure position, and a discharge
position connected to a fluid reservoir (29), and in that
the control valve (218) is controlled, on the charging
position side by the hydraulic pressure (P_h) in the
upstream circuit (40), and on the discharge position side
15 by the hydraulic pressure in the downstream circuit (200)
of the ram, so that the assistance force (F_a) applied to
the assistance piston (32) during the disengagement phase
is proportional to the hydraulic pressure (P_h) in the
downstream circuit (44).

20 29. Control system (10) according to claim 26,
characterised in that the distributor (218) is controlled
by an electronic control unit (220).

30. Control system (10) according to any one of the
25 preceding claims, characterised in that the piston (32)
comprises at least one elastic element (46, 106) that
returns the piston (32) towards its upstream position.

31. Control system according to any one of the preceding
30 claims, characterised in that the assistance device (5)
comprises a regulation means (218) which varies the value
of the assistance force (F_a) according to the upstream
pressure P_h in the upstream chamber (34) of the
assistance cylinder (30) or the downstream pressure P_h in

the downstream chamber (36), or a combination of the two pressures according to a predetermined assistance law.

32. Control system according to any one of the preceding
5 claims, characterised in that the orifice (520) is a
channel pierced in the piston (320) along the axis of the
rod (480) and the end of this rod (480) has a
complementary shape with respect to that of the start of
the orifice (520) so as to produce the obstruction of
10 this orifice when the rod (480) is in abutment on the
piston.